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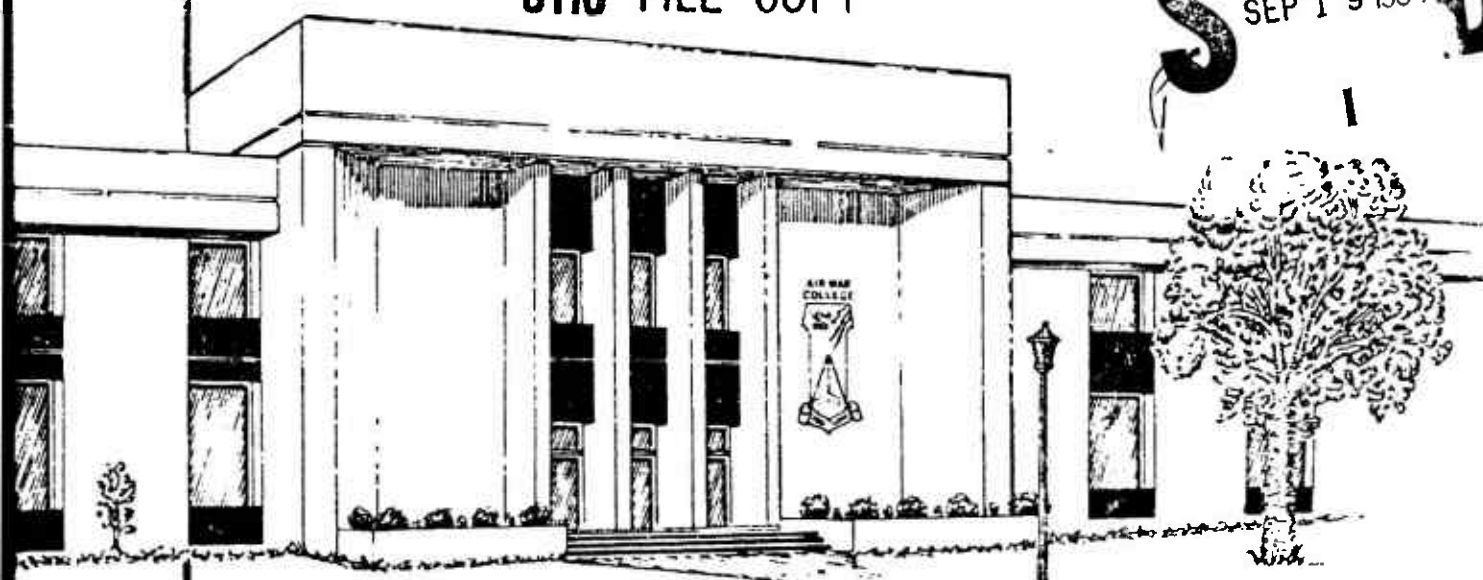
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THE F/A-18 FIGHTER/ATTACK AIRCRAFT PROGRAM

By WING COMMANDER PETER G. NICHOLSON
ROYAL AUSTRALIAN AIR FORCE

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THE F/A-18 FIGHTER/ATTACK AIRCRAFT PROGRAM

by

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Wing Commander, RAAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY

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THE RESEARCH REQUIREMENT

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MAXWELL AIR FORCE BASE, ALABAMA

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

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AUTHOR: Peter G. Nicholson, Wing Commander, RAAF

The history of the F/A-18 Fighter/Attack aircraft program is traced from its beginning as a result of the Naval Air Combat Fighter competition to 1984 when its future seems assured. Factors which affected the acquisition process are examined with a view to identifying those which might have significant influence on future tactical aircraft programs. Not surprisingly, the dominant factor is shown to be program cost and a number of strategies to minimize the effects of budgetary constraints are identified. The need for long term planning and a rational, comprehensive approach to controllable, programmatic factors is seen as essential in order to maintain adequate production levels in the face of less controllable economic factors. A coordinated approach to the operational requirements of the four United States tactical air forces is considered mandatory in order to promote commonality and develop multirole solutions. If this is not achieved, the F/A-18 program indicates that Congress is likely to intervene and play a more active role in areas where professional military expertise has traditionally held sway.

BIOGRAPHICAL SKETCH

Wing Commander Peter G. Nicholson was born and raised in Northam, Western Australia and graduated from the University of Western Australia as a mechanical engineer. He joined the Royal Australian Air Force in 1968 and after pilot training and operational conversion flew the Mirage III in Malaysia. In 1973 he attended the Empire Test Pilots' School in the United Kingdom, graduating as dux of his class. He has subsequently worked as a test pilot, flight commander and squadron commander at Aircraft Research and Development Unit where he has been involved in the flight testing of all aircraft types in the RAAF inventory. Wing Commander Nicholson is a graduate of the RAAF Staff College and has served in staff appointments in the Directorates of Technical Plans and Air Force Plans in Department of Defence (Air Force Office). He is a graduate of the Air War College class of 1985 and holds a Masters degree in Public Administration from Auburn University. He will take up an appointment in the Directorate of Operational Requirements on his return to Australia.

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CHAPTER I

INTRODUCTION

The 546 F/A-18 aircraft proposed in the Five Year Defense Program for the fiscal years 1986 to 1990, represent more than half of the tactical aircraft funded by the United States Navy in that period. By the early 1990s, 28 Navy and 12 Marine squadrons will fly the F/A-18 (1). Production of 1377 F/A-18 aircraft has been planned to meet Navy, Marine Corps and Foreign Military Sales (FMS) requirements well into the 1990s. Yet, the program has been a source of considerable controversy since its inception in 1974 and as recently as 1982 there was considerable pressure to terminate it in favor of other solutions to the operational requirement. That the program was not terminated is due more to good fortune than good management because technical development problems, parochial interests, the decreasing priority of defense spending and adverse economic conditions combined to produce a particularly hostile environment for a major new weapons system program.

On the other hand, reaction to budgetary constraints on defense programs in this period produced

some unexpected results which in addition to shaping the course of naval tactical aviation for many years, may set the scene for all major defense programs in the future. In particular, the apparent breakdown of the subgovernment arrangements between the aircraft industry, congressional committees and administrative agencies, and the active role played by Congress in forcing a more rational solution indicates that a more coordinated approach by the Services to tactical programs will be necessary in the future.

The aim of this paper is to trace the evolution of the F/A-18 program with a view to identifying the major factors in the policy formulation process which have led to the development and procurement of the aircraft. These factors will then be analysed to determine the strengths and weaknesses of the present weapons system acquisition process and to indicate areas where improvements can be effected.

CHAPTER II

BACKGROUND

The genesis of the F/A-18 multipurpose fighter aircraft was the Navy desire in the early 1970s for the development of a single type to replace the F-4 Phantom II and the A-7 Corsair II. This new aircraft would be required by the mid 1980s to replace Navy and Marine Corps F-4 aircraft in the fighter role and Navy A-7 aircraft in the light attack role. A further impetus to this desire was budgetary constraint attributable to the increasing cost of tactical aircraft. In particular, the high cost of the F-14/Phoenix weapon system and the consequent smaller numbers procured had spurred consideration of a lower cost aircraft which could be employed for fleet air defense in circumstances when a lesser capability would suffice. This aircraft was seen as complementary to the F-14/Phoenix weapon system in this role, not as a substitute. The hope was that a new, low cost aircraft could be developed to replace the F-4 and A-7 aircraft and also complement the F-14 in close range, high threat, fleet air defense missions.

Similar budgetary pressures had led the Air Force to seek a lower cost, lesser capability complement to its

frontline fighter aircraft, the F-15 Eagle, in order to maintain the tactical fighter force structure of 26 wings (1). This new aircraft was initially called the Air Combat Fighter (ACF) but because of the correlation between weight and cost the program later became known as the Lightweight Fighter (LWF) program. A flyoff competition was held between two experimental lightweight fighter aircraft types, the YF-16 developed by General Dynamics (GD) and the YF-17 developed by Northrop. In January 1975 this was decided in favor of the GD product and the F-16 became the "low" complement of the F-15 in the high-low capability/weight/cost mix of Air Force tactical fighter aircraft.

During the course of the Air Force ACF competition, Congress intervened in the Navy quest for a new low cost tactical fighter and directed in the conference report on the Department of Defense Appropriations Act, 1975, that the development "...make maximum use of the Air Force Lightweight Fighter and Air Combat Fighter technology and hardware" (2). This report also changed the name of the Navy program from VFX and VFAX (experimental carrier fighter and experimental carrier attack fighter) to Navy Air Combat Fighter (NACF). However, Navy evaluation of designs submitted by industry teams of GD/LTV Aerospace

and McDonnell Douglas/Northrop concluded that even with significant modification the F-16 would not satisfy Navy requirements for carrier operations. Therefore the Navy announced in May 1975 that it would proceed with the development of a derivative of the YF-17 proposed by McDonnell Douglas/Northrop which would be known as the F-18.

Full scale development (FSD) contracts for the F-18 were awarded in 1976 to McDonnell Douglas as prime contractor for the airframe, with Northrop as the main subcontractor, and to General Electric for the engines. Initially, the Navy planned to procure 11 FSD aircraft followed by 400 F-18 fighter aircraft and 400 slightly different A-18 aircraft optimized for the light attack mission (3). Continuing Congressional and Department of Defense pressure for commonality changed this to 800 F/A-18 dual mission "strike-fighters" which differed according to mission by operational level configuration changes. Acknowledgement of declining force levels in the face of an increasing threat, and recognition that low, inefficient production rates were driving unit costs upwards led to the total number of aircraft planned being increased to 1377 in 1978 (4).

CHAPTER III

THE FIRST ROUND

The ground rules for the first round of what was to become a slugging match between the aircraft manufacturing companies was set by the congressional mandate which directed the Navy to substantially base the NACF on the aircraft selected for the Air Force ACF. The Navy solicited proposals for the NACF through the Air Force to both companies competing for the ACF. Each company elected to team with another company with naval aircraft development experience. Hence, GD collaborated with LTV Aerospace, the maker of the A-7, to submit three derivatives of its YF-16 design, while Northrop combined with McDonnell Douglas, the maker of the F-4, to submit a derivative of its YF-17 design with a choice of two engine types. The three GD/LTV proposals, designated the 1600, 1601 and 1602, were rejected as unacceptable for carrier operations on several grounds, while the McDonnell Douglas/Northrop model 267 with General Electric F-404 engines was considered satisfactory (1). The model 267 was subsequently declared the Navy's choice and designated the F-18 on 2 May 1975.

One week later LTV Aerospace Corporation filed a formal complaint with the General Accounting Office (GAO), the investigative arm of Congress, against the company's principal customer, the Navy, on the grounds that the selection of the F-18 violated the Congressional directive requiring the NACF to be a derivative of the F-16. The contention of LTV was not that it was trying to force the Navy to accept its version of the F-16 but rather that if the YF-17, the loser of the ACF competition was a viable contender, then the NACF competition should be reopened to allow all aircraft manufacturers to compete (2). As the manufacturer of the A-7 which was slated to be replaced by the winner of the competition, LTV had a strong vested interest in denying this opportunity to McDonnell Douglas and Northrop. Another aircraft company with an equally strong vested interest was Grumman, the manufacturer of the F-14.

The precursor of the F-14 as the aircraft to replace the F-4 for fleet air defense was intended to be the product of the first determined attempt by Department of Defense to achieve a higher degree of commonality in aircraft types in the tactical air forces (3). This was the triservice experimental fighter (TFX) program which led to the General Dynamics F-111. After the Navy

rejected the F-111B as unsuitable for carrier operations, an industry-wide competition was held to develop an alternative vehicle for the Phoenix missile. This was won by Grumman who developed the F-14, an aircraft which incorporated many features of the F-111. However, the cost of this very advanced weapon system resulted in fewer being procured than expected in the first few years of production and the fixed price contract led to severe financial problems for Grumman. The subsequent contractual argument and compromise soured relations between the company and the Navy. Grumman's difficulties were ameliorated by the sale of F-14 aircraft to Iran and the renegotiation of contracts for production of the aircraft for the Navy (4). Nevertheless, the LTV protest was seen as another opportunity to prove the cost effectiveness of the F-14 and perhaps result in it being ordered instead of the new NACF.

A notable feature of major aircraft procurement programs before the advent of the F 18 had been the remarkable degree of cooperation between the major actors, in particular between the aircraft manufacturers (5). The major contracts had been shared among the big companies both by legislative intent to maintain several competing sources and by tacit agreement between the manufacturers

themselves. The arrangements were characterized by the mobility of the highly skilled professional work force which moved from company to company as new aircraft programs were conceived and moved through design and development to production. In fact, these arrangements typified the existence of a "subgovernment...a network of military and civilian personnel in the Department of Defense, defense contractors and the interest groups that represent them, and members of Congress." (6) However, the NACF program saw the confluence of a number of factors which worked against the operation of this subgovernment or "cozy triangle" in furthering the mutual interests of each element.

The end of the Vietnam conflict saw the decline of military aircraft inventories and a general reluctance of the Congress to fund defense programs, especially those which were tactical in nature. Moreover, 1972 had seen the election of many younger, antiestablishment members of Congress who were determined to reestablish the balance between the legislative and executive branches which had been upset by the Nixon and previous administrations. There was a general reaction against the abuse of executive power demonstrated by Watergate and a desire to increase the role of Congress in controlling perceived excesses by executive agencies, including the

military services. The oil crisis and a stagnating economy also worked to hold down defense appropriations in a general climate of increased Congressional scrutiny of major military programs (7).

Under these conditions, it was obvious to the major contractors that the F-18 program was likely to represent a large share of a smaller cake. There was a very real possibility that the loser (or losers) might well be compelled to withdraw from the military aircraft business altogether. The LTV protest provided the pretext for Grumman to present its case again and the Chief Executive Officer of the company testified to the Tactical Air Power Subcommittee of the Senate Armed Services Committee. The gravity of the situation is demonstrated by the unusual decision of Grumman to oppose the course of action desired by its major customer in testimony before the body which would probably have the final say in the matter. This did not go unnoticed by the participants and is exemplified by a short dialogue between a member of the subcommittee and the Deputy Chief of Naval Operations (Air Warfare):

Senator Symington. "And, did you ever before hear of a corporation appearing against another corporation's product, against the wishes of the service in question?" Admiral Houser. "No, sir. I didn't. There have been a lot of things about this one that I don't understand..." (8).

The former comity of the companies had disappeared in the

face of economic ruin and the cozy triangle of industry, administration and legislative interest groups appeared to have broken down.

The Grumman strategy in testimony before the Tactical Air Power Subcommittee was to demonstrate the competitive cost of the F-14 when the production volume was increased. The comparisons presented by Grumman indicated that the unit cost of an F-14 was less than that estimated for the F-18 for similar production volumes, especially if the production rate was increased to levels comparable with that planned for the F-18 (nine aircraft per month at that time). Grumman recognized that the F-18 was being purchased to perform two missions, so the company included the costs required to procure sufficient A-7 aircraft for the light attack role in addition to the cost of F-14 aircraft for the fighter role in its estimates of total program costs. This approach raised questions about the validity and meaningfulness of cost and combat effectiveness comparisons of different aircraft types. For example, the procurement cost of various combinations of F-14 and A-7 aircraft did not include any research and development costs for the F-14 on the grounds that funds for these elements had already been expended. This decreased the total program cost for additional F-14

aircraft and artificially deflated the unit procurement cost. Similarly, comparisons of combat effectiveness pitted professional military judgement against quantitative system analysis of the relative combat capabilities of F-14, F-18 and A-7. However, both these vexing issues were shelved when the General Accounting Office delivered its judgement that the language of the conference committee report was not legally binding on the Navy. This passed the responsibility back to Congress (9).

CHAPTER IV

ACTION IN CONGRESS

The breakdown of the subgovernment arrangements placed the onus for protection of constituency interests back on individual members of Congress. Those affected now concentrated on influencing decisions of the authorization and appropriation committees or attempting to garner support on the floor. The program was politically sensitive because of the impact it would have on jobs at this time of high unemployment (1). Hence, members of Congress were aligned according to the geographical distribution of the prime contractors and major subcontractors. For instance, both Representative Dale Milford (24th District, Texas) and Senator John Tower (Texas) submitted statements to the Tactical Air Power Subcommittee of the Senate Armed Services Committee opposing the F-18 program and supporting the position of LTV Aerospace which was based in Texas (2). On the other hand, supporters of the F-18 program in House debate included Representatives Lloyd, Wilson and Burgener from California (the home of Northrop); Burlinson and Ichord of Missouri (McDonnell Douglas); and Conte of Massachusetts (where the General Electric engines for the F-18 were to be made) (3).

Many of the arguments used against the F-18 in Congress encompassed issues which were of more general concern than the benefits accruing to particular contractors, or even of the large job creation potential of the program. There was particular concern that the Navy selection of the F-18 was a flagrant violation by the executive branch of specific legislative direction to utilize substantial hardware and technology of the Air Force ACF. The argument was that ignoring the direction of the conference committee report made a mockery of the well established authorization/appropriation process (4). The Navy position was that while the letter of the legislative mandate had not been followed, the spirit had been observed, and further, the chairmen of both the House and Senate Appropriation Committees had been informed and had agreed to the course of action subsequently followed by the Navy (5). The controversy of this issue and the fact that only the legislature was in a position to arbitrate had been anticipated in the conclusion of the GAO report denying the LTV protest: "The statement... suggests that the Congress will be closely scrutinizing the Navy's choice... before funds will be provided. Thus, the ultimate determination regarding further F-18 development has yet to be made." (6)

Other wide ranging issues raised in debate in Congress and in testimony before committees concerned the role of the Office of the Secretary of Defense (OSD) in the acquisition process and the coordination of tactical airpower requirements of the armed forces. Senator Goldwater, a high ranking officer of the Air Force Reserve and a long serving member of the Senate Armed Services Committee, was a persistent critic of the influence of the civilian bureaucracy in matters involving professional military judgement. He saw the F-18 program as an attempt by OSD to foist a "McNamara whiz kid solution" on the Navy against the better judgement of the professional military advice proffered by Navy. The precedent of the unsuccessful TFX program appeared to play a significant part in his opposition to the F-18 program and he sponsored the appearance of George Spandenberg, whose expert views had played a decisive role in killing the naval version of the F-111, before the Tactical Air Power Subcommittee (7). He was especially critical of the lack of coordination between the services, which he saw as the true role of OSD (8), on the subject of tactical air power requirements and the existence of four substantially different and costly tactical air forces: Air Force, Navy, Marines and Army. Again, the driving factor was program cost and while the congressional committees were

deliberating, reports of differences of opinion between executive agency estimates surfaced in the press (9).

The catalyst for renewed public discussion of the estimated cost of the F-18 program and of cost comparisons between different aircraft programs was the leaking of a memorandum written in the Office of Management and Budget (OMB). The gist of the document was that an additional 400 F-14s would be \$900 million cheaper than a comparable number of F-18 aircraft (10). Then, a second "issue paper" prepared in OSD claiming that the Navy had underestimated the life cycle cost of the F-18 program by \$1.6 billion was also leaked (11). Since both these documents were apparently leaked by Navy officers thought to favor the F-14, press speculation was that the Navy was playing a giant charade hoping that Congress would cancel the F-18 program on the grounds that either it was too expensive or that the Navy had indeed deliberately violated the Congressional mandate. Since cancellation of the F-18 program would require another competition and delay introduction of a new aircraft to the fleet by about two years, the main beneficiary would be Grumman which could produce additional F-14 aircraft immediately. The subtlety of this tactic was that it had the potential to raise the ire of Congress, discredit the F-18 proponents

within the Navy, demonstrate the failure of OSD in overlooking individual service proposals, and gain the additional fighter capability of the F-14. Indeed, when asked at a news conference if he suspected that the admirals may be playing an elaborate trick, the Secretary of Defense, James Schlesinger, replied: "As a former denizen of the Bureau of the Budget, having watched over three agencies, I have acquired some degree of bureaucratic suspiciousness that will never disappear." (12).

As the Comptroller General had anticipated in his report, the whole issue was too political to be settled anywhere but in the Congress. Despite the recommendation of the authorization and appropriation committees of both houses, an amendment to the Defense Appropriation Bill for fiscal year 1976 (HR 9861) to delete funding for the F-18 program was offered in both the House of Representatives and the Senate (13). The bill was considered first in the House and most representatives of districts or states which stood to gain from the F-18 program spoke against the amendment in debate on the floor. A key spokesman was Representative Charles H. Wilson of California, who was well prepared for the debate and systematically refuted all the points against the program which had been raised

In the press. For example, he presented a letter from the Director of OMB in which the secret issue paper was described as a preliminary, staff level document that did not represent OMB policy (14). Similarly, he read into the record correspondence from the Chief of Naval Operations, Admiral Holloway, which clearly stated the Navy requirement and desire for the F-18 to dispell any doubt that the preceeding events had been a ruse to obtain funding for additional F-14 aircraft. When put to the vote on 2 October 1975, the amendment was lost 243 to 173 (15), and a similar amendment offered by Senator Goldwater in the Senate was also lost 64 to 19 on 14 November (16).

CHAPTER V

AIRCRAFT COST COMPARISONS

Having established the program and appropriated funds for full scale development of the aircraft, the future of the program seemed assured. However, it was challenged again on cost grounds only two years later. To understand the basis for this challenge, it is necessary to examine the nomenclature and methodology of program cost analysis. The "flyaway" cost is the cost of the airframe, including the powerplant, avionics, built-in items of armament and government furnished equipment. The latter might include items of equipment bought in large numbers under a separate contract and supplied to the prime contractor for installation, such as inertial navigation sets. The "procurement" cost is the flyaway cost plus ground support equipment peculiar to aircraft type, technical publications, contractor services up to acceptance by the service customer and spare parts for an initial period of service, typically 30 months. Finally, the "program" cost attempts to measure the cost of the total acquisition by adding research, development, test and evaluation costs and other overheads such as construction of special facilities and plant to the procurement cost (1).

These three measures of cost can be expressed in either "now year" dollars which apply to a particular fiscal year and have a constant value, or in "then year" dollars which vary according to inflation and program activity such as production quantity and rate. For programs which extend over long periods of time, then year costs reflect actual inflation and program changes in past years, and estimated inflation rates and planned program activity for future years (2). Data for the F/A-18 program which shows the difference between then year and now year costs as estimated at the start of development in 1975 and at the time of production decision in 1978 is shown in Table 1. Table 1 also gives a breakdown of flyaway, procurement and program costs estimated at these times. Table 2 shows the growth in these costs as estimated for three successive budgets for Fiscal Years 1977, 1978 and 1979. The inflation rate used by DOD to estimate future costs in then year dollars is mandated by OMB on the basis of administration prediction of economic activity, rate of growth and so forth and is invariably an optimistic (ie lower) value than actually achieved in a given period (3). This is one reason for the apparently inexorable increase in the cost of major weapon systems in the past few years.

Another reason is the sensitivity of cost to production volume and rate and the tendency in recent years for procurement quantities of major weapon systems to be reduced for budgetary control purposes. Contractor overhead costs such as debt servicing on production plant and other administrative costs are more or less fixed by the delivery rate established by program authorization. Hence, a decrease in the number of units procured in a given year results in increased unit flyaway and procurement costs because these overheads must be spread over fewer units than planned. In addition, the total program cost for the same number of aircraft is also increased by the amount of the contractor overhead cost for each additional year the program is extended. Increasing the total number of aircraft procured under the program while maintaining a fixed yearly rate will decrease the unit program cost because other program overheads such as research and development costs are amortized over a greater number of units. Thus, there is both a quantity and a rate effect on unit costs.

One rule of thumb for estimating the effect of production quantity on cost is that doubling the production quantity results in a twenty percent decrease in unit flyaway cost (4). During testimony to the Senate

Tactical Airpower Subcommittee in 1975, the Chairman and Chief Executive Officer of Grumman presented information which showed the effect of production quantity and rate on F-14 unit procurement cost (see Table 3) (5). The base for this data is the unit procurement cost under the conditions applicable at the time (\$14.0 million in 1975 dollars, 6 aircraft per month, 125 aircraft remaining in the program). The blank spaces in Table 1 are for inappropriate combinations of quantity and rate. For example, it would be very inefficient to produce 800 aircraft at the rate of 3 per month. The data of Table 3 shows that an increase in both production quantity and rate is necessary to achieve the greatest decrease in unit program cost.

As well as these three measures of acquisition costs, major weapons systems can also be compared on the basis of their "through-life" or "life-cycle" costs which includes the operating and maintenance costs over the 15 to 20 year life of the systems in addition to the costs of acquisition. This cost of ownership approach attempts to include all the factors which might influence the decision to proceed with a particular program. In this respect, the F-18 appeared to have a significant advantage over the F-14 insofar as the fighter role was concerned. In 1975,

the Senate Armed Services Committee was told that the operating costs of the F-18 were estimated as 60 to 65 percent of those for the F-14 (6). If 800 F-18 aircraft were procured, the savings over a 15 year period compared with the same number of F-14s were predicted to be more than \$4 billion (7). Similar levels of savings were estimated three years later in testimony by Navy witnesses to the same committee (8).

However, comparisons on the basis of either acquisition or life-cycle costs are subject to considerable doubt and alternative interpretation if the systems being compared have their development/production cycles in different time periods. This can introduce confusion and conflict in the decision making process if it is not recognized that there is a substantial degree of subjectivity involved in comparison of what may not be comparable values. First, programs which have already been established and funded have a significant level of "sunk" costs which may be lost if the program is abandoned. Alternatively, policy makers could take the view that this investment has already been made and should not be considered in comparison with a new program which has yet to have funds expended on, for instance, research

and development. This is the view presented by Grumman in arguing its case against the F-18 .

Second, there are difficulties introduced by the method of accounting and whether or not costs are expressed in then or now year dollars. During periods of inflation, measuring expenditures of an established program in then year dollars raises the apparent cost because funds expended in the earlier period when the dollar was worth more are expressed in terms of inflated dollars of less value. On the other hand, costs of a yet-to-be-established, future program are apparently less because the expenditures will actually be incurred in the future when the dollar is worth less than the present value. For example, in then year dollars the unit program cost of the F-14 was estimated in early 1978 (ie in 1977 dollars) at \$22.5 million compared with the F/A-18 value of \$17.6 million - a difference of \$4.9 million. The values in 1979 dollars, however, were \$33.2 million for the F-14 and \$13.1 million for the F/A-18 - a difference of \$20.1 million (9). This situation is further complicated if through life costs in different time frames are taken into account or if there is an attempt to discount funds tied up in production facilities or other capital equipment concerns rather than being invested.

Thus, comparisons of the acquisition costs of programs occurring in different periods of time are best compared using constant value, now year dollar values. However, this method is less valid for comparison of operating costs and still less for comparison of life cycle costs. On the other hand, annual appropriations are made in then year dollar values and budgetary decisions are generally made on the basis of the value of the dollar in that year. Furthermore, consideration of funds already expended, or sunk costs, during deliberations on the budget are also only meaningful in present dollar values. The conclusion therefore is that considerable caution should be exercised in comparing costs because in addition to programmatic differences such as production quantity and rate, different economic and accounting conditions can result in meaningless comparisons. Under these circumstances, the cost benefits of one program over another may be illusory because of presentation under favorable conditions. Tables 4 and 5 contain the costs calculated in 1982 of four tactical fighters now in the inventories of US forces. These tables show the unit program costs of each aircraft estimated in the base year, or first year of development, the cost growth to 1982, and the estimated cost up to 1984.

CHAPTER VI

THE V/STOL LOBBY

As the redesignated F/A-18 program approached the production decision point in 1978, two separate but related factors surfaced to threaten its continuation. The first involved differences in operational requirements for the light attack role between the Navy and the Marine Corps. The second, more fundamental factor, involved congressional criticism of the whole concept of operations of naval tactical airpower. Both involved the use of vertical/short takeoff and landing (V/STOL) aircraft. Marine experience with the British Aerospace AV-8A Harrier indicated that V/STOL considerably enhanced the effectiveness of Marine organic light attack capability. The AV-8A could provide close air support of amphibious landings from smaller assault and helicopter carriers which could stand in closer to shore than was safe for the larger conventional carriers. Once a beachhead was established AV-8A operations could shift from the amphibious assault carriers to quickly prepared landing pads or short runways where its V/STOL capability could be fully exploited. In particular, rather than loitering airborne, V/STOL capability ensured rapid reaction of the

AV-8A from ground alert in close proximity to engaged troops.

This new mode of tactical operations prompted an expanded Marine Corps requirement for V/STOL light attack capability and the development of the AV-8B Harrier II by McDonnell Douglas with the original designer of the aircraft, British Aerospace, as a major subcontractor. Full scale development of the AV-8B was also nearly complete in 1978 and the Marine Corps required funds to move the program into production but it was directly threatened by the impact of the F/A-18 on the budget. The Marine Corps was still committed to the F/A-18 as a fighter replacement for the F-4 because a high agility, supersonic V/STOL aircraft was not technically feasible for many years. As the prime contractor for both programs, McDonnell Douglas was in the very unusual situation of benefitting no matter what the decision, although the F/A-18 program was very much larger in monetary terms than the AV-8B (1).

The other source of criticism of the F/A-18 program was a small congressional group led by Senator Gary Hart of Colorado. His opposition was directed not at the need for a new tactical fighter, but at the large,

nuclear powered aircraft carrier on which the whole naval concept of operations was based. Hart had long considered that the large carrier was too vulnerable, especially to the new generation of cruise missiles, to justify the funds and combat assets associated with it. His proposal was to accelerate the development of V/STOL for all tactical airpower roles and to build more, smaller carriers. In his view, the F/A-18 program perpetuated the need for larger carriers and should be terminated. To this end, Hart offered an amendment to the 1979 Defense Appropriations bill which deleted funding for the F/A-18 program. This amendment was defeated after debate in the Senate in which Senator Kennedy of Massachusetts defended the F/A-18 program and the big aircraft carriers on the grounds of the heavy investment in them to date and the fact that they still had many years of service (2).

The issue was clouded further by disputation between the executive branch and Congress over the congressional role in defense policy making. The 1979 Defense Appropriations Bill was vetoed by the President on the grounds that inclusion of a nuclear powered aircraft carrier distorted administration funding priorities. The cost of the carrier depleted other more important programs of funds and "...cut into the muscle of our military

defense," President Carter told a nationally televised press conference on 17 August 1978. "This is not a question of money...It's a question of how that money is going to be spent." (3). The impending elections caused an amended bill deleting funds for the additional carrier to be rushed through the legislative process and the President had his way. However, the widespread discontent and concern of legislators that the committee process and congressional oversight of policy had been subverted or diminished, was to be reflected in funding of additional large nuclear carriers in later years. This had an important impact on the F/A-18 program.

CHAPTER VII

BUDGETARY IMPACTS ON FORCE LEVELS

The middle years of the 1970s, a time of economic recession and oil crisis, saw smaller defense appropriations than were requested by the military services. This period saw declining Navy tactical air force levels because of wastage exceeding acquisition for several successive years (1). Aging of the force was also reducing aircraft availability, utilization and capability in the face of an increasing threat from the Soviet Navy. The result was that the number of aircraft procured was reduced to remain with budget guidelines, leading to higher unit procurement costs and even fewer aircraft being bought each year. The situation was exacerbated by the number of aircraft types in the Navy and Marine Corps inventory. The problem was how to break this ever decreasing cycle without reducing the number of embarked air wings.

The Air Force faced the same problem and had led the way in solving it through the concept of the "high/low" mix, pruning the inventory of as many aircraft types as possible, and committing to high volume production of the F-15, F-16 and A-10 aircraft. The

active search for Foreign Military Sales and other overseas sales helped to increase production volumes even further and were also of considerable benefit. The vehicle for achieving the same benefits for the Navy was intended to be the F/A-18 but this could only be accomplished within the administration's fiscal constraints at the expense of some other major program. The contenders for this dubious honor were the F-14, AV-8B and the Lockheed P3C anti-submarine warfare aircraft. Alternatively, the F/A-18 could be cancelled, thus allowing increased numbers of another type to be procured.

The F-14 could not be cancelled on military grounds because there was no substitute for it in the role of long range fleet air defence. Paradoxically, the P3C was inviolate because cancellation would raise the unit program cost of aircraft to be supplied under existing and pending contracts to allied nations, many of whom complained at this prospect. Further, loss of sales to overseas customers would open the door for increased market penetration by the British Aerospace Nimrod. Hence the choice was really between the F/A-18 and the AV-8B and the political muscle of individual congressmen enabled the Secretary of Defense, Harold Brown, to impose a solution

on the Department of the Navy despite strong internal and public protests, with the knowledge that Congress would accede to the choice. Thus, in early 1978, the proposed Marine Corps program of 336 AV-8B aircraft was cancelled except for prototypes, and the number of production F/A-18 aircraft increased from 800 to 1366 (2). In addition, the production rate of the F-14 was drastically slowed and the A-7E program terminated by Secretary Brown's budget guidance for the 1979 Defense Appropriations bill.

The influence of particular members of Congress was instrumental in having this decision endorsed by the legislature. For example, the F/A-18 program was supported by the voting strength of the California delegation and the power of that from Massachusetts. Speaker O'Neill and Senators Brook and Kennedy who were collectively referred to as the TET offensive (Tip, Ed and Ted) lobbied extensively to gain support for the proposal (3). On the other hand, there was no incentive for McDonnell Douglas to lobby for the AV-8B, and the traditional congressional support for the Marine Corps was no match for the pro F/A-18 forces. However, there was considerable dispute between OSD and the upper echelons of the Department of Navy. This became public with the leaking of a memorandum from R. James Woolsey, Under

Secretary of the Navy, to the Secretary of Defense, protesting the decision (4).

In the face of severe budget constraints, the Department of Navy had proposed cancelling the F/A-18 in favor of more F-14 and A-7 aircraft for the Navy and more F-4 and new AV-8B aircraft for the Marines while embarking on an aggressive V/STOL research and development program to pave the way for the introduction of a new generation of smaller carriers. The Navy position was that it wanted a force mix of F-14, F/A-18 and AV-8B but that if something had to give, it should be the F/A-18. Secretary Brown and the systems analysts in his division of Program Analysis and Evaluation considered the technical risk of V/STOL to be too high (5). They thought that the introduction of the F/A-18 would provide an extended breathing space and not foreclose the option of remaining with conventional takeoff and landing carriers. However, the driving factor was present and future budgetary considerations because Secretary Brown believed that land based air was more cost effective for major contingencies and that the major carrier force should ultimately be reduced in size (6). The substantial public comment on the dispute noted the impact the decision would make on the future of the Navy and gloomily likened the situation

to that of the ill-fated TFX (7). This was pointed criticism because Harold Brown was the Under Secretary responsible for the TFX program in the Kennedy Administration (8).

To alleviate the immediate pressure on the steadily declining numbers of tactical aircraft, programs were initiated to refurbish and update aircraft in the inventory. The Service Life Extension Program (SLEP) and Conversion In Lieu Of Procurement (CILOP) were relatively inexpensive stopgap measures which would maintain or minimize the reduction of existing force levels until the F/A-18 program reached mature production rates. (9). To alleviate the political pressure, Congress also added funds for the procurement of additional A-7 and F-14 aircraft over those requested by the administration, in part using funds saved by cancellation of the nuclear powered carrier, and this also assisted in maintaining force levels.

Another factor bearing on the willingness of Congress to accept Secretary Brown's solution of moving to high volume production of a single type was the poor track record of naval tactical aircraft in comparison with the Air Force where program costs were concerned. For

example, between fiscal years 1976 and 1979, the Navy procured 315 aircraft of five different types for \$6.5 billion, while the Air Force bought 1143 aircraft of three types for \$13.5 billion. That is, for about twice the cost the Air Force purchased more than three times the number of aircraft with unit costs of \$12 million compared with \$20 million (1979 dollars) (10). Of course, the operational and technical requirements of carrier based aircraft are more severe than those of land based aircraft. For example, undercarriages must be designed for higher sink rates and the aircraft must withstand a more highly corrosive environment. Nevertheless, it is difficult not to apportion much of the blame for the dilemma of increasing unit procurement cost and declining force levels on the Navy's management of the problem.

CHAPTER VIII

THE FINAL PARRY

With the passage of the 1979 Defense Appropriations bill, the future of the F/A-18 program seemed assured. However, only two years later, reports surfaced in the aviation press that the Navy was considering termination again. During the final stages of test and evaluation of the full scale development aircraft, technical and performance problems had been encountered, and there was reluctance on the part of the Navy to enter into contracts for full scale production until they had been solved. In addition, the GAO had investigated both the identified problems and Navy management practices and recommended a slow down until all aspects of had been cleared up (1). More importantly however, the cost of the program had apparently increased significantly because of an inflation rate of 14 to 16 percent compared with the six to eight percent mandated by OSD and OMB for the preparation of Navy estimates (2).

Although no single technical problem was serious enough to jeopardize the future of the program, in combination they slowed development of the aircraft and resulted in lower than planned initial procurement

quantities. At the same time, the lead time for delivery of critical components had increased from the 32 months experienced with the F-15 to 44 months for the F/A-18 (3). When combined with the budget constraints forced on the Navy by the Carter Administration, the overall result was a much slower production build up than was typical of similar aircraft such as the F-14, F-15 and F-16. For example, the first 100 F-16 aircraft were delivered about 36 months after first flight, whereas at the procurement rate planned by the Navy in 1980, the F/A-18 would not achieve this until about 60 months after first flight (4). This had the effect of moving the program further into the future and in a time of high inflation increased the program cost in then year appropriated funds enormously.

Another factor which had the potential to drive the program cost of the F/A-18 still higher was the continued uncertainty of the 336 aircraft for the Marine light attack squadrons. While the administration had denied Marine Corps requests to purchase the AV-8B, Congress had continued to fund development and long lead items for production. Moreover, unlike the F/A-18, the AV-8B had been remarkably free of development problems and the Commandant of the Marine Corps proposed bringing forward the date for the aircraft's initial operational

capability. Additionally, the strong interest expressed by the Royal Air Force in a collaborative AV-8B venture would further decrease the unit program cost of this aircraft for the Marines (5). Reduction of the number of F/A-18 aircraft from 1377 to 1030 by eliminating the Marine requirement would drastically increase the unit program cost and subvert the goal of the Administration of a common aircraft type for both services.

The Navy's response to the severely constrained fiscal guidance given by the administration for the 1982 - 1986 five year defense plan (FYDP) was to reduce the number of aircraft from 656 to 396 in the current plan (1981 - 1985). This would have the effect of increasing the unit program cost from \$21 million to about \$27 million in then year dollars (6). Under these circumstances, the option of terminating the program was very real and the previously strong support of the OMB and OSD began to fade (7). However, Congress was very sensitive to the cost issues and as in previous years arbitrarily increased the number procured in the first year of the five year plan from 24 to 48. This was not an isolated act however, because in this last year of the Carter Administration, the Congress was becoming increasingly concerned about the level of spending on

defense and had increased funds committed to a number of tactical programs.

In addition to these disputes between the budget conscious and professional military sectors of the administration in the light of escalating costs and unresolved doctrinal disagreements, considerations associated with foreign military sales also played a part in deliberations on the F/A-18 program. Canada had ordered 137 aircraft in May 1980 on the understanding that the program would be continued and in 1981 Australia was on the verge of also deciding on a replacement for the Mirage aircraft of its tactical fighter force. The choice was between the F-16 and the F/A-18 and any doubt about the future of the latter program would certainly swing the advantage to the F-16. Other prospective buyers of the aircraft were Spain, Israel and Egypt, so foreign military sales had the potential to reduce the unit program cost of the aircraft for the Navy and Marines. Hence, the Chief of Naval Operations was quick to reassure the Royal Australian Air Force that the program was not in jeopardy and still had the full support of the Navy (8).

The issue was finally resolved by the election of the Reagan Administration which promptly began to fulfill its promise to restore the readiness and capability of all components of the United States military forces by a massive infusion of funds. Several initiatives had an impact on the F/A-18 program: the decision to expand the size of the Navy to 600 ships, including two (later increased to four) more large carriers, immediately increased the requirement for F/A-18 light attack aircraft for the Navy by two squadrons (24 aircraft) per carrier. By also increasing the requirement for F-14 fighter and A-6 medium attack aircraft, this decision was politically neutral. The doctrinal dispute between the DOD and the Marine Corps over the AV-8B was decided in favor of the Marines with the authorization of Harrier II production, aided by the decision of the Royal Air Force to also buy the aircraft. The 336 F/A-18 aircraft previously earmarked for Marine light attack squadrons were diverted to upgrading Navy Reserve squadrons, enabling earlier retirement of Reserve F-4 aircraft (9) and maintaining planned production of the F/A-18 at 1377 units.

CHAPTER IX

FACTORS INFLUENCING THE ACQUISITION PROCESS

A feature of the F/A-18 program has been the constant struggle between a short term, incremental approach forced on an expert agency by budgetary constraints and a longer term, rational comprehensive approach enforced by political muscle. The process has been disturbed by bureaucratic politics, compounded by professional pride and esprit de corps, and marked by persistent conflict between the legislature and the executive. Contrary to conventional wisdom, the Congress had a broader perspective than the administration, and frequently increased funding to maintain a more efficient production rate above that requested in the budget presented by the President (1).

The subgovernment of the aircraft industry interests, the bureaucracy and the congressional subcommittees was unable to hold together under severe budgetary pressure. This led to the situation of each contractor protecting his own interest and using the influence of individual congressional representatives to further the cause of his specific program. The F/A-18 program prevailed because it mustered support from a wider

range of more influential congressmen than did proponents of the F-14 and A-7. However, the lesson for the future is clear. Building a coalition of support in the legislature is an essential ingredient for success and this is likely to be more difficult both to establish and to maintain in the absence of the cozy triangle.

In a climate of decreasing expenditure, program authorization is subservient to the appropriation function. Fine tuning by the Appropriation Committees may distort force structure and force levels and disrupt the planning of the expert bureaucracy and the specialized authorization subcommittees. The budget is technically complex and very political and the military services must live with this fact. Therefore, program managers must minimize or eliminate the deleterious effects that parochial interests between the Services and between the political and professional sections of the bureaucracy will have in this environment. The F/A-18 program was very lucky to have survived the process unscathed. Without the fortuitiously widespread congressional support it enjoyed, the disputes between the Navy and the Marines, and between the department of Navy and Department of Defense, may have resulted in termination of the program.

The sensitivity of unit costs to production quantity and rate and the less predictable effect of inflation, means that longer range planning and larger procurement quantities must become the norm in the future. Program managers should attempt to decrease overhead costs by obtaining approval for multiyear procurement and discouraging attempts by the legislature to fine tune or micromanage large programs (2). This will require a major effort to sell programs in the Congress and this should be the responsibility of political appointees, leaving the professional and technical decisions to the experts in the agencies. Failure to do this will almost certainly provoke the intervention of Congress in program details, as happened with the F/A-18, but the outcome may not always be as favourable to the program as was the case on this occasion. In short, economic and technical development problems are likely to provide more than enough difficulties in a major weapons system program without provoking further unpredictable programmatic changes by Congress.

Another way to increase the production quantity as a means of reducing unit cost for future tactical programs, especially aircraft, would be to more closely coordinate the requirements of the four tactical air

forces of the United States than is presently the case. The aim of this closer coordination would be greater commonality of major items of equipment through development of more multirole air vehicles and platforms. This will necessitate compromise on the operational requirements of the different major users of each aircraft type. The quality versus quantity argument vis-a-vis the threat is no longer valid in the face of the significant qualitative improvements of Soviet tactical aircraft and United States tactical force levels must be sustained (3). This will not be possible if small production runs of many aircraft types drive the unit cost to exorbitant levels. Furthermore, unless the military services and the Department of Defense agencies coordinate their activities, Congress is again likely to intervene and impose a solution. Operational requirements must be placed in the context of achievable force structure and this requires a long term rational, comprehensive approach rather than incremental adjustments on a one year budgetary cycle.

CHAPTER X

CONCLUSIONS

The F/A-18 program has shown that the factors which influence major weapon acquisition programs have changed dramatically. The previous cozy triangle of aircraft industry, administrative agency and congressional committee, which had sustained a widespread and varied military aircraft production base, appears to have wilted under the pressure of escalating costs. The need for multiple sources of expertise and a large production base for reasons of national security is likely to be in direct competition with the need to reduce costs well below those attainable by small production runs of many aircraft types. The F/A-18 program shows clearly that the cost argument will win this tussle.

The consequences of this are that building a coalition of support for a particular program in Congress will be more difficult than in the past. The difficulties of satisfying a wide range of powerful constituent interests in the absence of subgovernment arrangements will be compounded by a more assertive legislature intent on maintaining its position in the panoply of government. The legislature has demonstrated that it is quite prepared

to intervene and restore some degree of rationality if the services or the Department of Defense persist with incremental approaches to budgetary problems. Satisfaction of sectional interests or particular needs will be much more difficult in this environment than in the past.

Therefore, more coordination and rationalization of individual service needs and a more directed attempt to sell the resultant program will be necessary in the future. This will inevitably require some compromise on technical performance and military capability, particularly when requirements and specifications are being determined. The aim must be to increase the degree of commonality between the individual service requirements to the maximum extent possible in order to accommodate these within the capabilities of a single weapon system which can then be produced in economic quantities. Although this approach may be reminiscent of Robert McNamara and the TFX, the fact remains that in the competition between military capability and single service missions, it is force levels which suffer. This is a recipe for disaster in war when the adversary can attain a similar level of qualitative performance and an imbalance of numbers can no longer be ignored.

TABLE 1
F/A-18 COST ESTIMATES 31 DECEMBER 1978
(\$ MILLION)

	DEVELOPMENT ESTIMATE (FY 75-88)	CURRENT ESTIMATE (FY 75-89)
DEVELOPMENT RDT&E TOTAL	1437.7	1598.2
PROCUREMENT FLYAWAY	4919.4	8370.6
SUPPORT	1127.8	1806.4
INITIAL SPARES	513.7	729.5
PROCUREMENT TOTAL	6560.9	10906.5
MILITARY CONSTRUCTION	18.0	18.3
TOTAL CONSTANT FY 75 \$	8016.6	12523.0
ESCALATION	4858.7	11500.3
TOTAL PROGRAM FY 78 \$	12875.3	24023.3
AIRCRAFT QUANTITIES		
DEVELOPMENT	11	11
PROCUREMENT	800	1366
UNIT COSTS		
PROCUREMENT CONSTANT FY 75 \$	8.201	7.984
ESCALATED \$	13.766	16.015
PROGRAM CONSTANT FY 75 \$	9.885	9.094
ESCALATED \$	15.876	17.446

Source

Department of Defence Appropriations For Fiscal Year 1980,
Hearings before a Subcommittee of the Committee on
Appropriations, United States Senate, 96th Congress, First
Session, Part 4, "Procurement", US GPO, Washington, 1979, p999

TABLE 2

F/A-18 PROGRAM
ESTIMATED UNIT COSTS
(1975 \$M & THEN YEAR \$M)

	FY 77 BUDGET		FY 78 BUDGET		FY 79 BUDGET	
	75\$	77\$	75\$	78\$	75\$	79\$
FLYAWAY	6.14	10.33	6.13	10.21	6.33	11.8
PROCUREMENT	8.19	13.71	8.15	13.52	8.33	15.3
PROGRAM	9.87	15.82	9.95	15.8	10.16	17.6

TABLE 3

EFFECT OF RATE & VOLUME OF PRODUCTION

ON F-14 UNIT PROCUREMENT COST

(1975 \$ Million)

NUMBER OF AIRCRAFT

RATE (AIRCRAFT/MTH)	NUMBER OF AIRCRAFT			
	150	300	600	800
3	\$14.4	-	-	-
6	\$12.9	\$12.5	\$11.9	\$11.8
9	-	\$12.1	\$11.1	\$10.5
12	-	-	\$10.8	\$10.2

Source

F-18 Program, Hearings Before the Subcommittee on Tactical Airpower of the Committee on Armed Services, United States Senate, 94th Congress, First Session, 17 Sep 75 & 8 Oct 75, US GPO, Washington, 1976, p

TABLE 4
AIRCRAFT UNIT PROGRAM COST COMPARISON
(31 DEC 82 SELECTED ACQUISITION REPORTS)
(BASE YEAR \$ MILLION)

AIRCRAFT TYPE	BASELINE ESTIMATE	CURRENT ESTIMATE	BASE YEAR	INCREASE	
				\$	%
F-14	11.350	15.380	1969	4.030	35.5
F-15	7.995	9.239	1970	1.244	15.5
F-16	6.652	7.842	1975	1.190	17.9
F/A-18	9.885	10.213	1975	0.328	3.3

Source

Department of Defense Authorization for Appropriations for Fiscal Year 1984, Hearings before the Committee on Armed Services, United States Senate, 98th Congress, First Session, Part 4, "Tactical Warfare", US GPO, Washington, 1983, pp 2085-6

TABLE 5
AIRCRAFT UNIT PROGRAM COST COMPARISON
(31 DEC 82 SELECTED ACQUISITION REPORTS)
(ESCALATED \$ MILLION)

AIRCRAFT	QUANTITY	THEN YEAR	FY 1984
F-14	845	39.55	41.31
F-15	1472	28.19	30.12
F-16	2173	20.02	17.35
F/A-18	1377	28.92	24.66

NOTE: F-15 & F-16 costs calculated using escalation indices for Navy aircraft. Air Force escalation probably varies slightly.

Source

Department of Defense Authorization for Appropriations for Fiscal Year 1984, Hearings before the Committee on Armed Services, United States Senate, 98th Congress, First Session, Part 4, "Tactical Warfare", US GPO, Washington, 1983, pp 2085-6

NOTES

CHAPTER I (Pages 1-2)

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4. Testimony by Vice Adm F.C. Turner, Deputy Chief of Naval Operations for Air Warfare on 20 March 1979 in Department of Defense Appropriations Fiscal Year 1980, Hearings Before a Subcommittee of the Committee on Appropriations, United States Senate, 96th Congress, 1st Session, US GPO, Washington, 1979, p 972

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3. Deborah Shapley, "Fighter Dispute Raises Questions About Navy's Future Role", Science, Vol 199, March 1978, pp 1317-1319
4. See Bert H. Cooper, The F/A-18 Hornet: Background Analysis of the Navy/Marine Corps F/A-18 Fighter/Attack Aircraft Program, Report No 78-224-F, Congressional Research Service, Library of Congress, 15 December 1978, pp 2-6
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6. Ira Sharkansky, Public Administration, W.H. Freeman & Co, New York, 1982, p 62
7. John T. Whelan, Some Conditions Affecting Continuity And Change In Congressional Committee Involvement In Defense Policy: The Case Of The House Committee On Armed Services, Doctoral Thesis, University of Pittsburgh, 1972, pp 169, 180-181
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